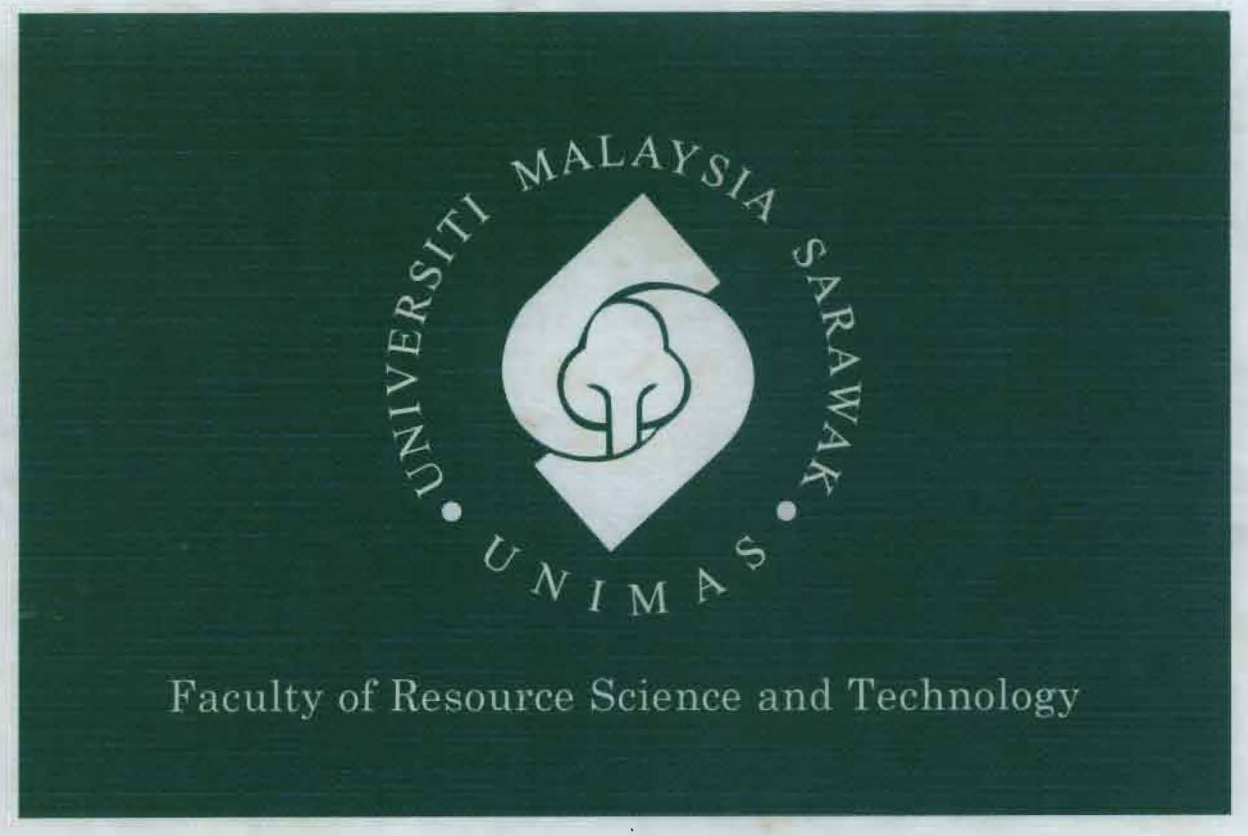


# RESPONSE OF *SAUROPUS ANDROGYNUS* (PUCUK MANIS) STEM CUTTINGS TO DIFFERENT LEVEL OF MARINE WASTE BASED FERTILIZER

**Nurul Ain Binti Mohammad Bukhari**

**Bachelor of Science with Honours**
**(Plant Resource Science and Management)**
**2013**

**UNIVERSITI MALAYSIA SARAWAK**

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Final Year Project Report ☑

Masters ☐

PhD ☐

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# Response of *Sauropus androgynus* (Pucuk Manis) Stem Cuttings to Different Level of Marine Waste Based Fertilizer

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This project is submitted in fulfillment of the requirements for the Degree of Bachelor of Science with Honours

(Plant Resources Science and Management)

Faculty of Resources Science and Technology

Universiti Malaysia Sarawak

2013

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## DECLARATION

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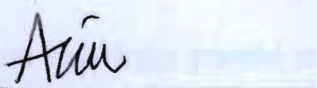

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### CHAPTERS

## LIST OF ABBREVIATIONS

| | |
|---|---|
| cm | Centimeter |
| kg | Kilogram |
| g | Gram |
| ha | Hectare |
| ANOVA | Analysis of Variance |
| NPK | Nitrogen Phosphorus Potassium |
| EC | Electrical conductivity |
| µS/cm | Microsiemens per centimeter |
| $L^{-1}$ | Per litre |
| mg | milligram |
| *Sauropus androgynus* | *S. androgynus* |

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# Response of *Sauropus androgynus* (Pucuk Manis) Cuttings to Different Level of Marine Waste Based Fertilizer

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## ABSTRACT

Jellyfish fertilizer made up from dried sludge of *Aurelia aurita* and *Stomolophus nomurai* was newly cultivated since jellyfish blooming phenomenon in Japan. Since there is lack of previous study regarding jellyfish fertilizer tested towards tropical plant, *Sauropus androgynus* were used in this study to determine the effect of marine waste based fertilizer in promoting growth for tropical crop as compared to normal practice application. Different level amount of jellyfish fertilizer of 1.0 %, 2.0 % and 3.0 % as treatment were used and compared with normal practice and previous study fertilizer application to test the fertilizer efficiency. Treatment C which indicated 1.0% of jellyfish fertilizer application was showed the best treatment for growth of *S. androgynus* in term of length of shoot, diameter of shoot, leaves number, shoot fresh weight and dry weight also root fresh weight and dry weight compared to other treatment. Condition of soil after fertilizer applied also showed soil in treatment C was best medium for *S. androgynus* to grow. However, presence of fungi that attacked to the jellyfish fertilizer and high concentration of fertilizer content disrupt the survivability of *S. androgynus* for this study.

Keywords: Jellyfish fertilizer, *Sauropus androgynus*, jellyfish blooming phenomenon, high concentration

## ABSTRAK

*Baja obor-obor terdiri daripada enapcemar kering Aurelia aurita dan Stomolophus nomurai baru dicipta selepas fenomena mekarnya hidupan obor-obor di Jepun. Disebabkan kurangnya kajian lepas mengenai baja obor-obor yang diuji ke atas pokok tropika, Sauropus androgynus telah digunakan dalam kajian ini untuk menetukan kesan baja berasaskan sisa daripada sumber lautan dalam menggalakkan pertumbuhan bagi tanaman tropika berbanding dengan amalan biasa dan penggunaan baja berdasarkan kajian lepas. Jumlah tahap yang berbeza bagi penggunaan baja obor-obor yang digunakan sebanyak 1.0 %, 2.0 % dan 3.0 % dan dibandingkan dengan amalam biasa dan penggunaan baja berdasarkan kajian lepas untuk menguji keberkesanan baja. Didapati, rawatan C iaitu 1.0 % baja obor-obor menunjukkan rawatan yang terbaik dalam S. androgynus yang termasuk panjang pucuk, diameter pucuk, bilangan daun, berat segar dan berat kering pucuk juga berat segar dan berat kering akar berbanding dengan rawatan yang lain. Keadaan tanah selepas baja digunakan juga menunjukkan rawatan C adalah medium terbaik untuk tumbesaran S. androgynus. Walau bagaimanapun, kehadiran kulat yang menyerang baja obor-obor dan kepekatan yang tinggi kandungan baja mengganggu kemandirian S. androgynus untuk kajian ini.*

Kata kunci: Baja obor-obor, *Sauropus androgynus*, fenomena mekarnya hidupan obor-obor, kepekatan yang tinggi

## 1.0 INTRODUCTION

Recently, organic fertilizer is an alternative option by people as compared to chemical fertilizer since there is a realization about organic fertilizer from adoption of ecological and sustainable farming practice able to reverse the declining trend in global productivity and environmental protection (Aveyard, 1988). This is because by using organic fertilizers, they able to reduce risk of pollution and they are environmental friendly. Organic fertilizers are based from natural materials such as plant or animal origin including livestock manure, crop residue, household waste, compost, green manure, woodland litter also other organic wastes such as dried sludge to enhanced physical condition of soil (Troeh & Thompson, 2005). As a contrast to organic fertilizer, chemical fertilizer have led to the pollution and contamination of the soil since they are contributing to water basin pollution, destroy micro-organisms and friendly insects also reduced soil fertility.

According to Fukushi *et al.* (2004), jellyfish fertilizer can be use for vegetables and influenced the growth of conifer and broadleaf seedlings. Organically grown foods are perceived as better quality, healthier and more nutritious than conventional fertilization since has contained elements N: P: K 13.1: 1.7 : 0.03.

Nowadays, people are more concerned about food safety. Organic fertilization has begun to spread in Southeast Asia countries in order to sustain production of safe food (Mihara *et al.*, 2007). They prefer food produced from organic farming which is not involved chemical substances. Chemical fertilizer able to reduce the protein content of crops and degraded the quality of carbohydrate (Marzouk & Kassem, 2011). Usage of organic fertilizer

to the crop will occupy good agricultural practices that support sustainable agricultural systems (Peyvast *et al.*, 2008). According to Venkataraman and Shanmugasundram (1992), long-term use of organic fertilizer is ecological friendly, economical, more efficient, productive and capable to access in marginal scope for small farmers compare to chemical fertilizers. In addition, organic fertilizer from waste product able to reduce the cost in agricultural production (Havlin *et al.* 2005).

Organic fertilizer is an effective agent for improving soil quality and structure in the long-term period. Marine waste based fertilizer is one of the type organic fertilizers. Marine waste based fertilizer made from jellyfish is innovatively used in Japan as fertilizers to minimize the blooming phenomenon of giant jellyfish population in Japan. Recently, the population of the giant jellyfish has rapidly increased in Japan and South Korea. This phenomenon contributed jellyfish population as one of excessive species and cause problem to them especially fisheries. Sting of jellyfish threatened people and may cause death. Thus, this may affect economic in Japan especially in tourism industry. Therefore, marine waste based fertilizer made from jellyfish is innovatively cultivated to minimize their problem.

There are few studies on the effect of jellyfish fertilizer on plant growth. It is because jellyfish fertilizer used still very new in the market and not much research has been done on it. Therefore, there is a need to study in order to understand the plant response towards jellyfish fertilizer. *Sauropus androgynus* was used in this study because its high nutritional content and the production of *S. androgynus* as vegetable crops give high profitable demand (Zaharah *et al.*, 1993)

The main objective of the study is to determine the effect of marine waste based fertilizer in promoting growth of tropical crop as compared to normal practice applications and previous study.

## 2.0 LITERATURE REVIEW

### 2.1 Organic Fertilizer

Plants require nutrients for normal growth and for completion of their life cycle. The elements supplied by air and water or taken up by plants only in mineral form from the soil or must be added as fertilizers. Fertilizers are materials that can be added to the soil to supply plant nutrients to supplement its natural fertility (Troeh & Thompsons, 2005). Organic fertilizer consists of organic matter referred to commonly as organic manure consists with decomposition product such as compost, peat or waste treatment plants such as sewage sludge or composted garbage. Chemical fertilizers would cause groundwater contamination.

According to Mohd Idris (1990), organic matter such as decaying grass, cow dung or manure, rotted leaves can prevent water from seeping out, improve fertility and structure of soil. Sandy soil cannot hold enough water for basic necessities as low water holding capacity thus with the addition of organic matter, sandy soils are more fertile as they can retained sufficient amount of water and improved soil structure. With addition of organic matter to clay soil are able to improved soil structure for ease plowing operation (Dempster, 1967). Organic materials provide nitrogen and minerals of other elements for the growth of vegetables when decomposed.

Organic fertilizers release nutrients slowly before supply nutrient to plant because depending on soil organisms to break down organic matter. Use of organic fertilizers continuously results in increased soil organic matter, reduced erosion, better water infiltration and aeration. Besides, higher soil biological activity as the materials decompose in soil and

increased yields after the year of application due to residual effects. However, the poor and excess applications of fertilizer will caused the fertilizer move into ground and surface waters thus, with proper handling of organic fertilizers can enhance the quality and effectiveness.

## 2.2 Jellyfish blooming phenomena

Jellyfish refers to free-floating gelatinous animal that belongs to phyla Cnidaria and Ctenophora are important components of ecosystems (Richardson *et al.*, 2009) and also provide ecological and commercial benefits for some human interest. The Sea of Japan is located to the northwest of Japan Asian continent (Plate 2.1) has seen outbreaks of giant Nomura jellyfish and caused serious consequences.

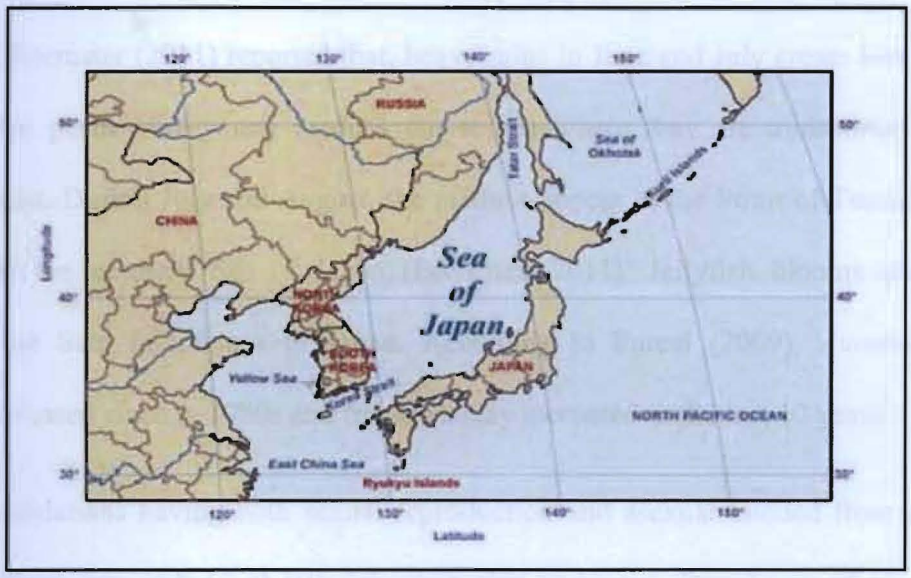


Plate 2.1- The map Sea of Japan.

According to Feemster *et al.* (2011), in recent years, *Nemopilema nomurai*, has experienced population explosions blooms that have caused hardships in the fishing industry and also affected other ocean thus changed the local ecosystem. The gargantuan Nomura's jellyfish found in the Sea of Japan coastline can grow up to 2 meters in diameter and weigh up to 200 kilograms (Schrope, 2012). Giant Nomura's jellyfish blooming phenomenon have been reported occurred every year starting from the year 2002. Problem appeared from blooming of jellyfish phenomenon is sting from jellyfish caused discomfort and in some cases medical emergencies are needed. Since human populations and recreational activities increases along coastal region, beaches infested with jellyfish population undoubtedly are detrimental by tourist thus lowering the tourism income for Japan (Sharp, 2001).

*N. nomurai* jellyfish breed in the waters of the Yellow Sea and grow to larva of medusa stage. Feemster (2011) reported that, heavy rains in June and July create low salinity water mass that pushes the young medusa out to sea where they are transported by the Tsushima current. During July and August, the medusa appear in the Strait of Tsushima and then spread to the northern Sea of Japan (Feemster, 2011). Jellyfish blooms also have increased in the Seto Inland sea in Japan. According to Purcel (2009), *Aurelia aurita* populations increased since in 1980s and tremendously increased in the last 10 years.

Since cnidarians having both sexual reproduction and asexual budded from a single polyp to transform into individual jellyfish, they able to bloom. Rapid rate of growth for jellyfish are faster than smaller fish. Jellyfish can survive in harsh conditions much better than many fish species. They have a varied diet so they able to survive in poor food supply

conditions. Jellyfish have ability to survive from starvation by shrinking in size and growing back when food is abundant (Richardson *et al.*, 2009). Since jellyfish eat zooplankton, thus it can reduce juvenile fish and food available to fish populations.

Available evidence reported that, human activities might potentially result in outbreaks of some jellyfish species. Jellyfish population are increasing in number have stimulated speculation about possible causes contribute into the phenomenon include climate change, eutrophication, overfishing, and invasion (Arai, 2001). Climate change caused warming of the sea surface from global warming and able to enhance water column stratification lead to flagellates migrate vertically and dominated as food for jellyfish than for fish. Eutrophication associated with increased nutrients, altered nutrients ratios and increased turbidy. This may bring more food source top polyps and jellyfish thus increases asexual reproduction rates. Jellyfish species are tolerant to $\leq 1$ mg $O_2$ $L^{-1}$and jellyfish polyps also tolerant to low oxygen (Condon *et al.*, 2001). Purcel (2009) also supported that jellyfish are tolerance to low-oxygen zones where few jellyfish predators can survive. Population of jellyfish *A. aurita* from phylum Cnidaria has increased in abundance in coastal water around Japan since *A. aurita* is highly tolerant of low dissolved oxygen concentration. Over fishing activities can removed the predator. Fishes such as chum salmon, butterfish and spiny dogfish are species of fish as predator to gelatinous species. Factors such as pollution and over fishing have a much greater effect in a closed basin than in the open ocean (Schrope, 2012).

According to Feemster (2011), Japan's west coast is spotted with small villages that have maintained a fishing economy with plenty of success until recent years. *N.*

*nomurai* jellyfish blooms began in this area in 2005 and have repeated most years, causing many villages to become economically unstable due to losses in fishing. Blooming phenomenon of jellyfish interfere tourist by stinging swimmers, clogging on nets, aquaculture by killing fish in net-pens and power plants by clogging cooling-water intake screens (Purcell, 2012). Whiteman (2002) also state that, increasing population of jellyfish have capture public attention on problem arised mainly from jellyfish stinging swimmers and interfering with fishing, aquaculture and power plant operations.

Interfering with fishing operations by clogging on set-net fisheries as shown in Plate 2.2. Large population of *A. aurita* jellyfish also clog seawater intake screens of power causing power reduction and shutdown thus required ongoing maintenance to remove clogging of jellyfish. Richardson *et al.*, (2009), also reported that jellyfish outbreaks have consequences in losses tourist revenue, power outages following the blockage of cooling intakes at coastal power plants, burst fishing nets, killing of farmed fish and contaminate catches and reduction in commercial fish abundance through competition and predation.

Plate 2.2- Jellyfish clogging on fishing net

## 2.3 Jellyfish fertilizer

Jellyfish fertilizer is one of the examples of organic fertilizer that innovatively cultivated since the increasing population of jellyfish in Japan which give several consequences. By recycling the natural resources, jellyfish fertilizer can reduced the impact of the blooming phenomenon of jellyfish and cost-saving.

Jellyfish fertilizer is made up from dried sludge of *A. aurita* and *Stomolophus nomurai* as shown in Plate 2.3. Normally, they are used as fertilizer for vegetable fields (Fukushi *et. al.*, 2003). Fertilizer from jellyfish made by putting of jellyfish in a container and leaving it at least 10 days. Then, supernatant liquid of jellyfish and a solid part of jellyfish will be separately formed. Next, the supernatant liquid of jellyfish will be heated under vacuum to precipitate sodium salts and simultaneously concentrate the supernatant liquid of jellyfish. This concentrated liquid of jellyfish is used as a concentrated liquid fertilizer.